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U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Subject: Catawba Nuclear Station
Docket No. 50-413
PIR 1-C90-0075; IIR C90-021-1

Gentlemen:

Attached is Problem Investigation Report 1-C90-0075, submitted concerning SETPOINT DRIFT ON PRESSURIZER SAFETY VALVES DURING SUCCESSIVE SURVEILLANCE TESTS. This report is being submitted as a Special Report with potential 10CFR Part 21 reportability concerns.

This event was considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

Tony B. Owen
Station Manager

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DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
PROBLEM INVESTIGATION REPORT NO. 1-C90-0075

SETPOINT DRIFT ON PRESSURIZER SAFETY VALVES DURING SUCCESSIVE SURVEILLANCE TESTS

ABSTRACT

On February 3-4, 1990, two of the three Pressurizer Safety Valves (PSVs) were removed from the Pressurizer to meet the Technical Specification (T/S) Surveillance test requirement. Both valves were shipped to the test facility at Wyle Laboratories. On February 23, Maintenance Engineering Services (MES) personnel were contacted that one valve failed to meet the 2485 psig +/- 1% setpoint requirement during its as-received setpoint test. Unit 1 was in "No Mode", core defueled, at this time. Further review by MES personnel of past surveillance tests indicated that the PSVs have failed to meet the setpoint requirement in 53.8% of their as-received setpoint tests. Setpoint drift on the PSVs beyond the T/S allowed +/- 1% acceptable range is attributed to a (manufacturer) Functional Design Deficiency. The cause of the setpoint drift is attributed to the affect normal plant operation and system condition can have on PSV performance. A Safety Evaluation will be performed, and station documents will be revised, as needed, to evaluate increasing the acceptable range to +/- 3% on the PSV setting. This report is being submitted as a Special Report with potential 10CFR Part 21 reportability concerns.

BACKGROUND

The Reactor Coolant [EIIS:AB] (NC) System consists of four heat transfer loops connected in parallel to the Reactor Vessel [EIIS:VSL]. Each loop contains a Reactor Coolant Pump [EIIS:P] and a Steam Generator [EIIS:HX] (S/G). The B loop also includes a Pressurizer, a Pressurizer Relief Tank (PRT), interconnecting piping [EIIS:PSP] and instrumentation necessary for operational control.

NC System pressure is controlled by the use of the Pressurizer where water and steam are maintained in equilibrium by electric heaters [EIIS:EHTR] and water sprays. Steam can be formed (by the heaters) or condensed (by the Pressurizer spray) to reduce pressure variations due to contraction and expansion of the Reactor coolant. Three spring loaded safety valves [EIIS:V] 1(2)NC-1, 2 and 3, are connected to the Pressurizer and discharge to the Pressurizer Relief Tank.

The three Pressurizer Safety Valves (PSVs) are of the totally enclosed pop-type. The valves are manufactured by Dresser, Model 6-31749A-2-XNC019, and are spring-loaded, self-activated with back pressure compensation. The combined capacity of the valves is equal to, or greater than, the maximum surge rate resulting from complete loss of load without Reactor Trip or any other control. Temperature indicators [EIIS:XI] in the safety valve discharge manifold alert the Operator to the passage of steam due either to leakage or valves lifting.

The Pressurizer is equipped with three Power Operated Relief Valves (PORVs) which limit system pressure for a large power mismatch and thus prevent actuation of the fixed high-pressure Reactor trip. The PORVs are operated automatically or by remote manual control. The operation of these valves also limits the undesirable opening of the spring-loaded safety valves. Remotely operated valves are provided to isolate the inlet to each PORV if excessive leakage occurs.

The PRT condenses and cools the discharge from the PSVs and PORVs. Steam is discharged through a sparger pipe under the water level. The PRT is equipped with an internal spray and a drain which are used to cool the tank following a discharge. The PRT is protected against a discharge exceeding the design value by two rupture discs which discharge into the Reactor Containment.

Technical Specification (T/S) 3.4.2.1 requires that a minimum of one PSV be operable with a lift setting of 2485 psig +/- 1% during operation in Mode 4, Hot Shutdown, or Mode 5, Cold Shutdown. With no PSV operable, immediate suspension of all operations involving positive reactivity changes and placement of an operable residual heat removal loop into operation is required.

T/S 3.4.2.2 requires all PSVs be operable with a lift setting of 2485 psig +/- 1% during operation in Mode 1, Power Operation, Mode 2, Startup, and Mode 3, Hot Standby. With one PSV inoperable, action shall be taken to restore the inoperable PSV to operable status within 15 minutes, or be in at least Mode 3 within 6 hours and in at least Mode 4 within the following 6 hours.

T/S 4.0.5 identifies that inservice inspection and testing of the PSVs shall be performed in accordance with surveillance requirements identified in the ASME Boiler and Pressure Vessel Code, Section XI, 1983 Edition including Addenda through the Summer 1983 Addenda (applicable Edition and Addenda required by 10CFR part 50, Section 50.55a(g)). Subsection IWV-3510 of the ASME Code identifies the testing schedule which requires all PSVs be tested once every five years. Subsection IWV-3510 required that setpoint testing be in accordance with ASME PTC 25.3-1976, Safety and Relief Valves performance Test Codes.

The 1986 Edition of the ASME Section XI Code, Subsection IWV-3510, references that setpoint testing be in accordance with AMSI/ASME OM-1-1981, Requirements For Inservice Performance Testing of Nuclear Power Plant Pressure Relief Devices. This document allows a +/- 3% acceptable range for setpoint test. Surveilance testing to subsequent edition of codes and addenda, or portions thereof, is acceptable to 10CFR Part 50, Section 50.55a(g)(3)(v). However, present T/S limitation required that the +/- 1% acceptance range be maintained at Catawba.

EVENT DESCRIPTION

On February 3-4, 1990, PSVs 1NC-001 and 1NC-002, Serial Numbers (S/Ns) BS-02867 and BS-02872, were removed from the Pressurizer to be tested per the T/S Surveillance requirements (reference Work Requests 4401 SWR and 4402 SWR). Replacement valves S/Ns BS-02870 and BS-02871, previously tested and verified to be at the required setpoint, were installed. On February 10, the valves removed were transported to the test facility at Wyle Laboratories. On February 23, Maintenance Engineering Services (MES) personnel were contacted that valve S/N BS-02867 (1NC-001) failed to meet the 2485 psig +/- 1% requirement during its as-received setpoint test. Unit 1 was operating in "No Mode", core defueled, at this time.

Station Compliance and MES personnel discussed the concerns of PSVs setpoints drifting outside of the T/S allowed tolerance. An MES review of past setpoint test results indicated that of the 13 tests performed on the PSVs, there were 7 valves (53.8%) that failed the Wyle Laboratories as-received setpoint test. These test indicated variances in setpoints from 2.5% high (2546 psig) to 1.5% low (2448 psig). MES initiated Problem Investigation Report (PIR) 1-C90-0075 identifying the recent drift in setpoint of valve S/N BS-02867 as a continuing problem.

CONCLUSION

This incident is attributed to a (manufacturer) Functional Design Deficiency due to the PSVs not maintaining the T/S setpoint of 2485 psig within the +/- 1% acceptable range. Catawba has experienced a drift in setpoints outside of the +/- 1% tolerance in 53.8% of the PSVs tested at Wyle Laboratories. A search of the Nuclear Plant Reliability Database System (NPRDS) identified 62 failures of PSVs to be within their setpoint requirements during surveillance testing

(valves tested in response in equipment problems, i.e. seat leakage, were not included). Of these 62 failures, which does not include any unreported incidents, 48 involved valves manufactured by Crosby Valve and Gauge and 14 involved valves manufactured by Dresser Industries. Information on 11 of 23 valves indicated that they had drifted more than +/- 3% (the remaining 39 valves did not identify the degree of setpoint drift). The cause of setpoint test failure was identified as undetermined or as normal setpoint drift due to aging and thermal cycling in 89% of the 62 failures. Improper test methods and procedures resulted in 11% of the failures. The corrective action taken in 68% of the failures was to adjust the setpoint within the acceptable range with no additional actions required. In 21% of the failed valves, disassembly, inspection, and cleaning did not identify any results that would indicate a cause other than normal setpoint drift. The failure history of the PSVs tested for Catawba is consistent with that of the NPRDS data, except that the Catawba PSVs have not drifted more than +/- 3% of the T/S setting.

The ability of safety valves to repetitively and consistently perform within the +/- 1% Code requirement is recognized as an industry wide concern. Recent developments include the effects of loop seal on the ability of safety valve to consistently repeat lifts within the desired setpoint range. The Westinghouse Owners Group is presently pursuing discussions to address the loop seal concerns in an effort to develop test methods and guidelines to improve setpoint repeatability. Catawba does not utilize loop seals in the PSV application and therefore does not have loop seal concerns. Other developments include test studies of safety valves to reseat at a desired pressure below setpoint without an extended blowdown period (EPRI Test Report NP-2770-LD and NP-2628-LD). Results from this study have been used to develop adjustments and tighter controls on the PSV ring settings. The affects of an extended blowdown on the PSVs are presently being evaluated for the Catawba feedwater line break accident (LER 413/90-001).

At Catawba, PIR 0-C90-0026 has been issued to address concerns of setpoint drift on the Main Steam Safety Valves (MSSVs). These concerns were originated when the valve manufacturer changed the equipment calibration constants that effected the tolerance by 1.0% to 1.5% of the original setting, which have a $\pm$ 1% acceptance tolerance of setpoint. PIR 0-C90-0026 identified that setpoint drifts greater than the +/- 1% experienced on 55% of these tests, indicating that the MSSVs and the PSVs have similar setpoint drift concerns.

The ability of the PSVs (or MSSVs) to consistently repeat setpoint lifts at any given pressure can be affected by many uncontrollable variables, including changes in temperatures, pipe loads and stresses, rate of pressure increase, condensate, and seat leakage. These variables may affect the relief setting in that the test conditions and the actual conditions may not be the same. Also, actual conditions may in themselves vary enough to cause variances in lift settings. Wyle Laboratories utilizes special tests and control procedures and methods to simulate the actual conditions that are expected to exist at Catawba (Wyle Test Procedure 1028). These efforts have contributed to maintaining relief settings consistently within +/- 3% of setpoint during successive surveillance testing, however, variances outside of the required +/- 1% of

setpoint have occurred. A Safety Evaluation will evaluate the effect of relief setting varying +/- 3% of setpoint due to the uncontrollable variables that affect valve performance. These efforts will be to evaluate the acceptability of as-found (Wyle Laboratories as-received) tests varying +/- 3% of setpoint. However, it is expected that the as-left (Wyle Laboratories as-shipped) test settings will remain within +/- 1% of setpoint. This will provide a 2% buffer, on both the high and low side, for setpoint drift without involving an operability question. This position, if determined acceptable, should be documented in the T/Ss, T/S Bases, or T/S Interpretations for Safety/Relief Valves.

The inability of safety valves to meet performance of the +/- 1% test requirement is identified as a recurring problem. The recommended and in-progress evaluation and the Westinghouse Owners Group efforts is expected to address these concerns and implement changes that will improve safety valve performance. A review of the Operating Experience Program (OEP) database revealed no previous events where equipment setpoints varied greater than their designed tolerance.

This report is being submitted as a Special Report in that setpoint drift greater than the +/- 1% required setting range could occur in subsequent as-found surveillance test. The cause of the setpoint drift could not be attributed to a known condition that would result in the inoperability of the PSVs. The setpoint drift is attributed to the effect that normal plant operation and system conditions can have on the ability of the PSV to consistently relief at the required setting. Therefore, no T/S violation has occurred.

This report is being submitted as potentially 10CFR Part 21 reportable; the PSV is considered a "basis component"; a drift in setpoint greater than +/- 1% is considered a "defect"; and the existence of a "substantial safety haza rd" is dependent upon the affect this setpoint drift can have on protecting the Reactor Coolant System for the individual plant normal operation and analyzed accident conditions. The requirement that the PSVs function within +/- 1% of setpoint was identified within manufacturer purchase specification CNS 1205.09-00-0001, Pressurizer and Main Steam Safety Valves. Setpoint drifts outside +/- 1% of setpoint due to normal operating conditions is in violation of the purchase specification.

CORRECTIVE ACTION

SUBSEQUENT

1) An NPRDS search was performed to identify an industry wide concern on setpoint drifts in PSVs.

PLANNED

1) A Safety Evaluation will be performed to address setpoints drifts of +/- 3% as an acceptable condition on the PSVs.

2) Station Documents (T/Ss, T/S Bases, or T/S Interpretations) will be revised/developed to incorporate the results of the Safety Evaluation.

3) The Safety Analysis of this report will be revised to incorporate the results of the safety evaluation.

SAFETY ANALYSIS

Variances in the PSV's setting greater than +/- 1% of setpoint have not been considered in the present safety analysis assumptions. The PSVs are required to function to limit NC System pressure during incidents involving a decrease in heat removal by the secondary system, decrease in Reactor coolant flow rate, and anomalies in reactivity and power distribution. A safety evaluation will be performed to address variances in PSV settings to +/- 3% of setpoint. The results of the safety evaluation will be incorporated into the Safety Analysis of this report.